



# Introduction

## Introduction:

- Most countries in the world already have **access to renewable energy**, but usually, it is **only a small percentage** of the electricity needed.[1]
- The sources we use to produce energy, such as **oil, coal and gas** [2], are **running out** and we have to change something if we want to still have electricity.
- Moreover, producing electricity from **fossil fuels releases CO2** into the atmosphere, which **causes global warming**.[3]
- **Renewable energy** is an element of **sustainable life**. Resources already available such as **geothermy, sunlight, water** and **wind** could be used in greater extent. In the future only renewable energy will be used. [3]
- However, currently, renewable energy sources only account for around **22%** of the **world's energy needs**.[1] Most European countries are below this average. There are also those where **more than half** of their energy is produced **from renewable sources**.

**The question is how did they achieve this?**

## Research Question

- Which countries in Europe have a higher percentage of renewable energy than the average percentage of global renewable energy consumption?
- How do they achieve this?

## Reference:

1. United Nations Statistics Division. (n.d.). *SDG Indicators — SDG Indicators*. Retrieved October 18, 2022, from [https://unstats.un.org/sdgs/dataContacts/?selectIndicator=7.b.1+Installed+renewable+energy-generating+capacity+in+developing+countries+\(in+watts+per+capita\)](https://unstats.un.org/sdgs/dataContacts/?selectIndicator=7.b.1+Installed+renewable+energy-generating+capacity+in+developing+countries+(in+watts+per+capita))
2. *Global Power Plant Database - Data | World Resources*

**Introduction**

**Exploratory  
Data...**

**Findings**

**Discussion**

**Conclusion**



# Exploratory Data Analysise



## Data Selection

- Which data exist in the world?
- Which data is needed?
- How can the data be acquired?

We have a lot of data on renewable energies in the world. Almost every country informs about the **percentage of consumption of renewable energies** (In Europe, all countries except Albania). What's more, all **power plants** are **registered** in databases, and information about them not only about where they are **located**, but also what **type** they are, when they were built and the **power** they generate.

I **needed data** on the percentage of **renewable energy consumption** in countries around the world, but I focused **on European countries**. I also used data on the location of **power plants** and compared the amount of **energy generated** by individual types in selected countries.

Most of my **data was acquired** from the **SDG indicators database**, but the information on power plants was obtained from the **global database of power plants** on the Global Resource Institute website.

Introduction

Exploratory Data...

Findings

Discussion

Conclusion



# Exploratory Data Analysise



## Data Cleaning & Transformation

- Which data needs to be cleaned and why?
- How did you clean your data?
- Which data transformation steps do you need to take?

Evidence

- The energy consumption **data needed to be cleaned** up because the values couldn't be visualized correctly. The **power plant database** contained a lot of **errors** and unnecessary information, some **names** of the countries were **incorrect** and often **misspelled**. The data on the percentage of renewable energies also needed to be cleaned, because most of the information was in the **wrong formats** and contained errors.
- I **formatted** and deleted some columns, set the first rows as titles, in some cases I had to **edit** the data first, for example by changing commas to slices to be able to change the data type. I also had to **remove** the duplicate countries and correct their names so that the data concerning e.g. the Czech Republic would also apply to the Czechia. In some cases, I also had to **convert** rows to columns

Introduction

Exploratory Data...

Findings

Discussion

Conclusion



# Exploratory Data Analysise



## Data Analysis

- What does the data distribution tell you for each variable of interest?
- What do the summary statistics tell for each variable of interest?
- Which data visualisation method is the most appropriate?

### Data distribution

- The **distribution of data** shows us information on renewable **energy in particular years**, mainly in Europe but also in the world. The data shows the **amount of power** that each type of power plant produces and allows it to be connected with selected countries.
- Summary statistics show the **average consumption** of renewable energies in the selected area. What's more, they also show what **percentage of energy** has been **produced** from a given **type** of power plant and what the correlation looks like between the year and the percentage of renewable energy
- The best way to show which European countries are above the average percentage of renewable energy consumption in the world is to visualize the **bar chart**. The **map** is the best to show in which countries we have a high percentage of renewable energy. And the **correlation** between the percentage of renewable energies over the years looks great in the **scatter chart** together with the trend line.

Introduction

Exploratory Data...

Findings

Discussion

Conclusion



# Findings

1

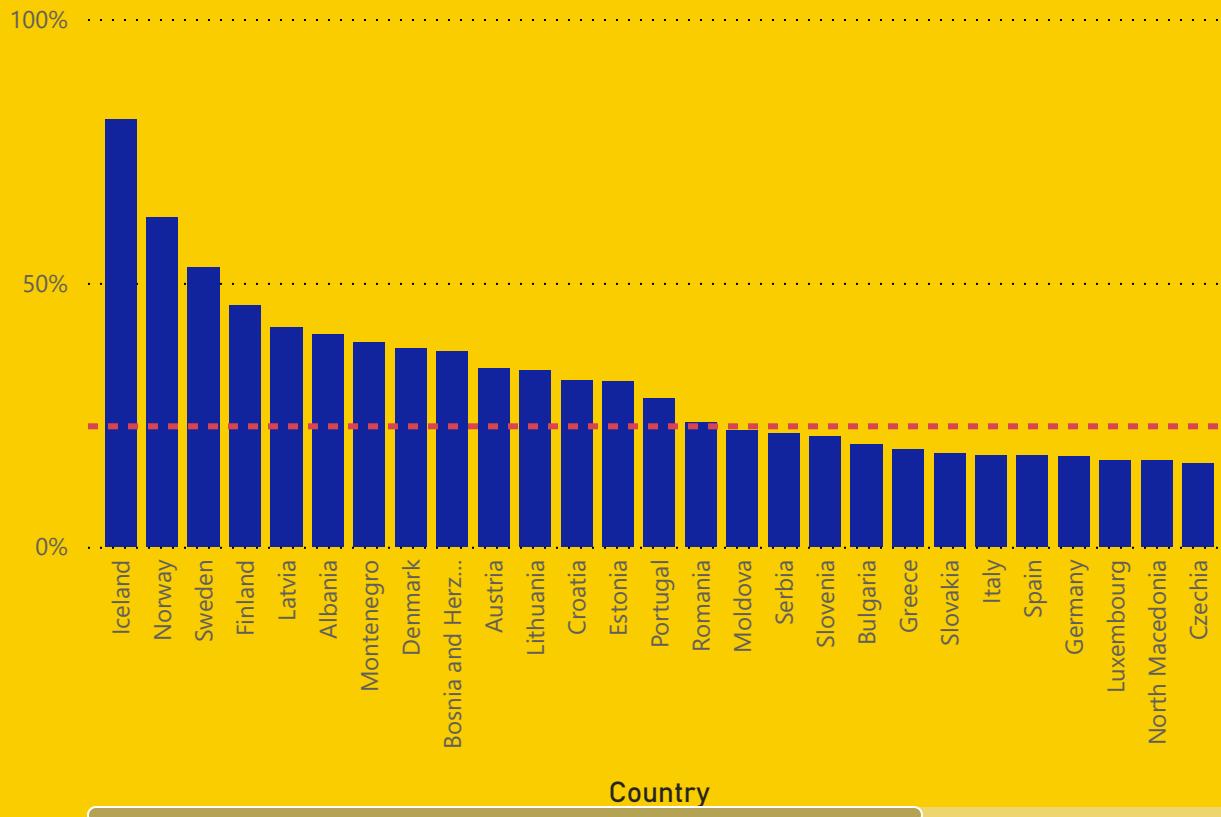
2

3

4

5

Average of Renewable energy percentage by Country in 2020



Average of Renewable Energy in the World

22.83%

Standard deviation of Renewable Energy in Europe

27.10%

Introduction

Exploratory Data...

Findings

Discussion

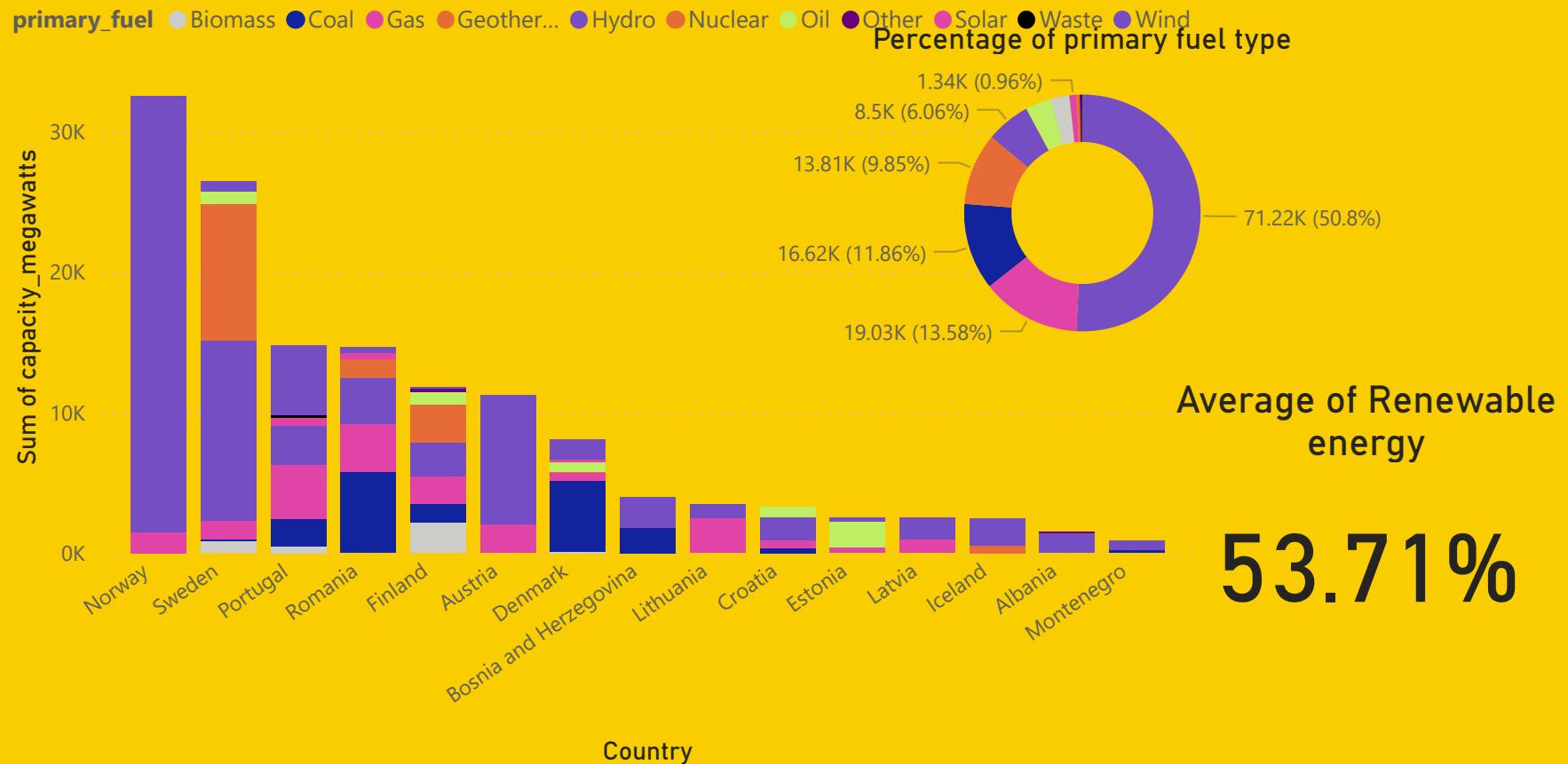
Conclusion



# Findings

- 1
- 2
- 3
- 4
- 5

Europe countries above the average renewable energies in the world in 2020



Introduction

Exploratory Data...

Findings

Discussion

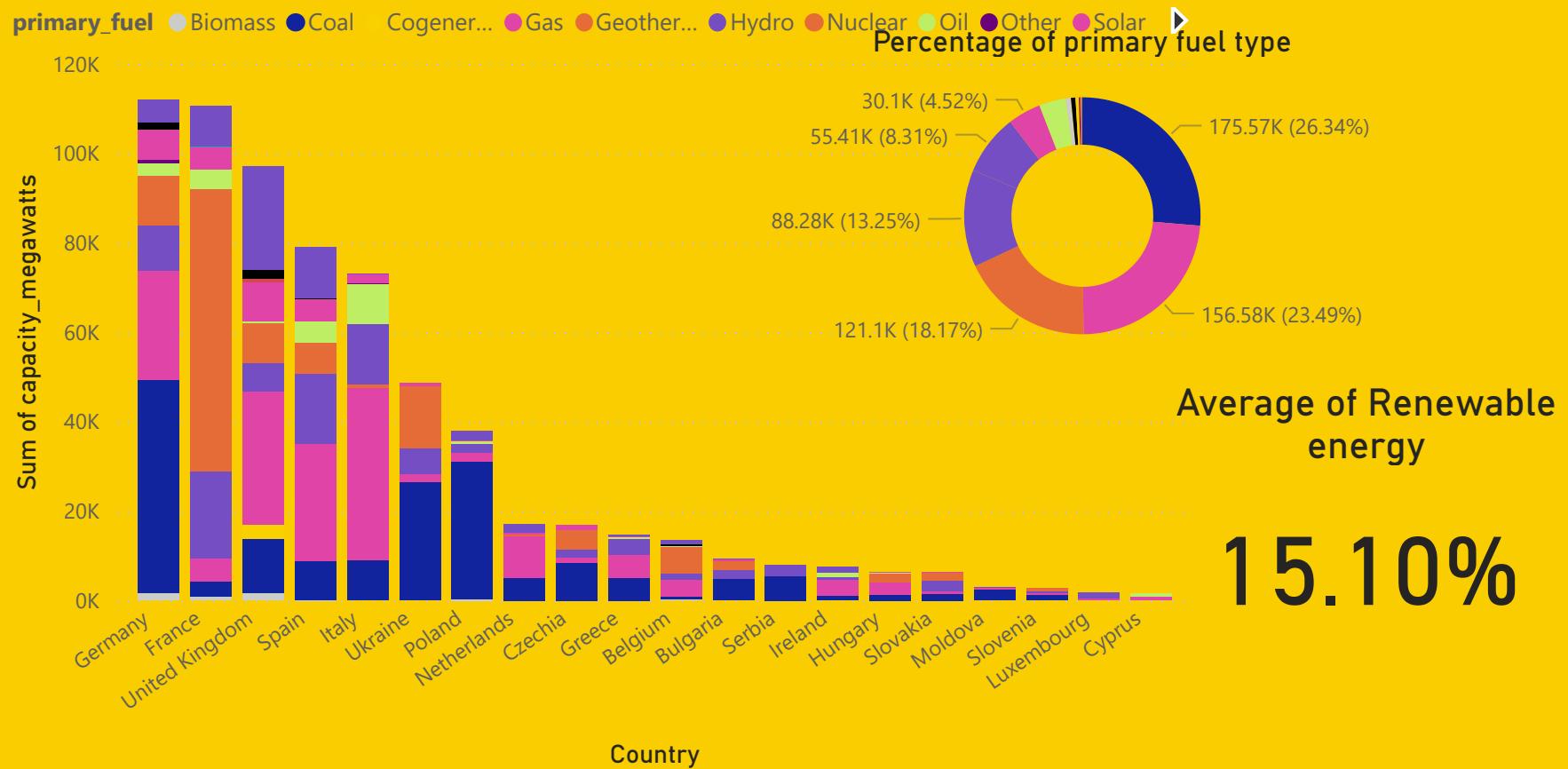
Conclusion



# Findings

- 1
- 2
- 3
- 4
- 5

European countries below the average renewable energy in the world in 2020



Introduction

Exploratory Data...

Findings

Discussion

Conclusion



# Findings

1

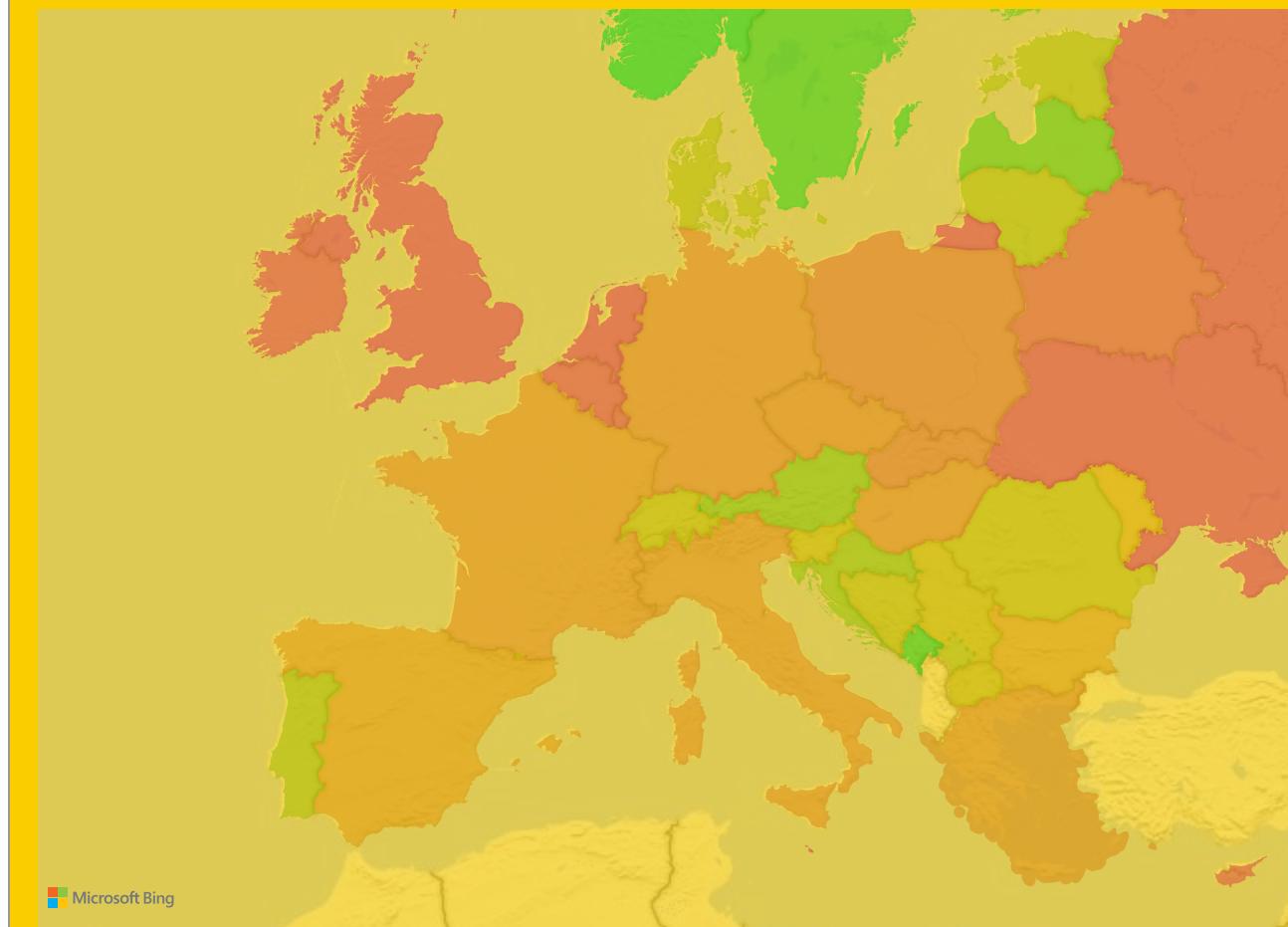
2

3

4

5

Average of Renewable energy consumption by Country

**17.93%**

Average of Renewable energ...

## Continent, Country

- ✓ Africa
- ✓ Antarctica
- ✓ Asia
- ✓ Europe

## Year

2000 2019

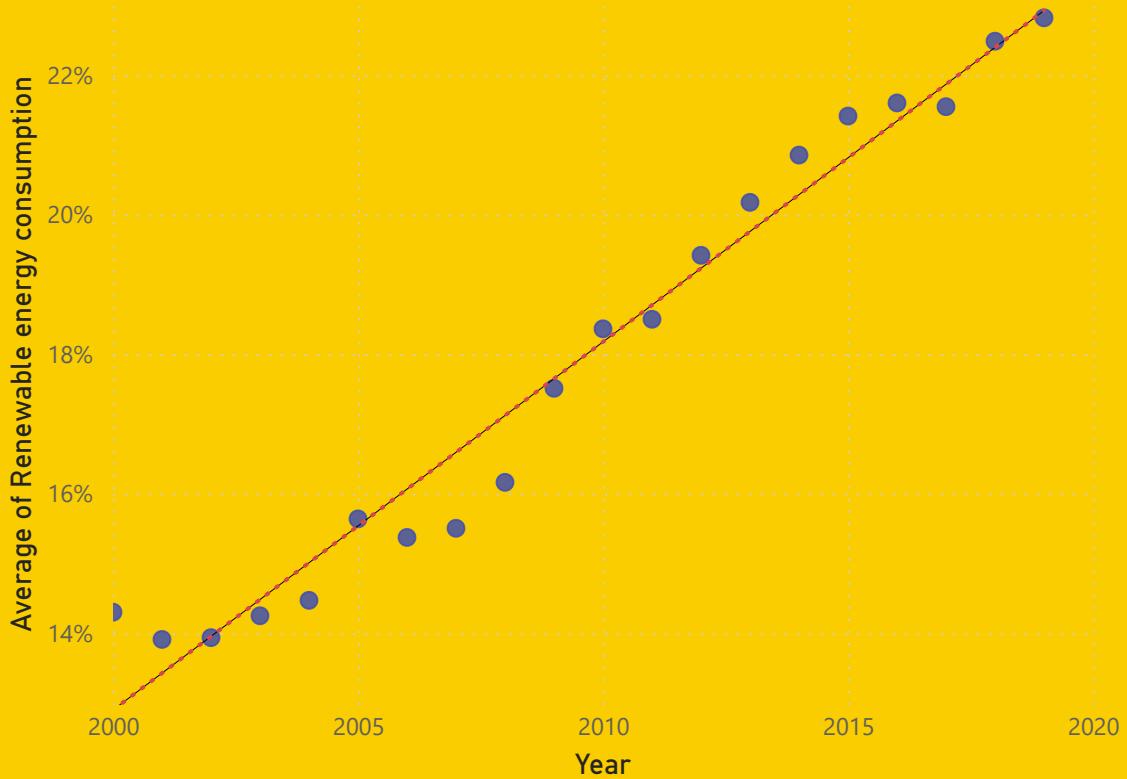
**Introduction****Exploratory Data...****Findings****Discussion****Conclusion**



# Findings

- 1
- 2
- 3
- 4
- 5

Correlation of the percentage of renewable energy by Years



Correlation coefficient

0.82

Europe

Introduction

Exploratory Data...

Findings

Discussion

Conclusion



# Discussion

- The analysis shows that European countries with **hydropower plants** that produce large amounts of energy are among the **top countries** with average **renewable energy above the average** renewable energy in the **world**.
- The **trend line** (*findings 5: scatter chart linking the % of renewable energies over the years*) shows that the average of **renewable energies** is **increasing** in Europe, which shows human effort in this matter.
- The map shows that the countries of **central Europe** have a **small percentage** of renewable energy and their power plants mostly use fossil fuels. On the other hand, **Scandinavian countries** have already riched the level of renewable energy of **over 50%** of their total energy. Power plants mainly use **water** and **wind** to produce energy.
- In the production of renewable energy **local environment**, , number and size of **rivers**, , **size** of the country, are among important factors. These should be taken into account in **future analyses**.

**Introduction**

**Exploratory Data...**

**Findings**

**Discussion**

**Conclusion**



# Conclusion

- In the world, **most** of the **energy** is produced from **fossil fuels**, but **some European countries** have a higher % of **renewable energies**. How did they **achieve this**?
- In Europe, there are **14 countries** with an average renewable energy **above the average** renewable energy in the world. The data shows that **Hydro power** plants dominate in these countries. In contrast, countries with a low percentage of renewable energy use mainly **coal** and **gas** in their power plants.
- In **future analyses**, we should investigate whether the natural **environment** has an **impact** on the consumption of **renewable energies**.
- The relationship between the year and the percentage of **renewable energies** shows that in Europe renewable energies are **becoming** more and more **popular**, this is positive news, but we still have to do everything to make it happen faster

Introduction

Exploratory Data...

Findings

Discussion

Conclusion

# Data Cleaning & Transformation

country	country_id	name	gppd_id	inr	capacity_t	latitude	longitude	primary_fuel	other_fuel	other_fuel	other_fuel	commissioning	owner	source	url	geolocation	wepp_id	year_of_commissioning
AFG	Afghanistan	Kajaki Hyd	GEODB004	33	32.322	65.119	Hydro							GEODB	http://gl/GEODB	1009793	2017	
AFG	Afghanistan	Kandahar	WKS00701	10	31.67	65.795	Solar							Wiki-Solar	https://w/Wiki-Solar			
AFG	Afghanistan	Kandahar	WKS00711	10	31.623	65.792	Solar							Wiki-Solar	https://w/Wiki-Solar			
AFG	Afghanistan	Mahipar I	GEODB004	66	34.556	69.4787	Hydro							GEODB	http://gl/GEODB	1009795	2017	
AFG	Afghanistan	Naghlu Da	GEODB004	100	34.641	69.717	Hydro							GEODB	http://gl/GEODB	1009797	2017	
AFG	Afghanistan	Nangarhar	GEODB004	11.55	34.4847	70.3633	Hydro							GEODB	http://gl/GEODB	1009787	2017	
AFG	Afghanistan	Northwest	GEODB004	42	34.5638	69.1134	Gas							GEODB	http://gl/GEODB	1009787	2017	
AFG	Afghanistan	Pul-e-Khui	GEODB004	6	35.9416	68.71	Hydro							GEODB	http://gl/GEODB	1009799	2017	
AFG	Afghanistan	Sarobi Dar	GEODB004	22	34.5865	69.7757	Hydro							GEODB	http://gl/GEODB	1009799	2017	
ALB	Albania	Bistrica 1	WRI10021	27	39.9116	20.1047	Hydro					1965		Energy Ch	http://ww/GEODB	1021225		
ALB	Albania	Fierza	WRI10021	500	42.2514	20.0431	Hydro					1978		Energy Ch	http://ww/GEODB	1021231		
ALB	Albania	Koman	WRI10021	600	42.1033	19.8224	Hydro					1985		Energy Ch	http://ww/GEODB	1021233		
ALB	Albania	Lanabrega	WRI10021	5	41.3428	19.8964	Hydro					1951		Energy Ch	http://ww/GEODB	1021236		
ALB	Albania	Shkopet	WRI10021	24	41.6796	19.8305	Hydro					1963		Energy Ch	http://ww/GEODB	1021238		
ALB	Albania	Ulez	WRI10021	25	41.6796	19.8936	Hydro					1958		Energy Ch	http://ww/GEODB	1021241		
ALB	Albania	Vau i Dijes	WRI10021	250	42.0137	19.6359	Hydro					1971		Energy Ch	http://ww/GEODB	1021242		
ALB	Albania	Vlora	WRI10021	98	40.4874	19.434	Other							Energy Ch	http://ww/GEODB	1021244		
DZA	Algeria	Adrar	WKS00685	20	27.908	-0.317	Solar							Wiki-Solar	https://w/Wiki-Solar			
DZA	Algeria	Ain Azel	WKS00652	20	35.88	5.475	Solar							Wiki-Solar	https://w/Wiki-Solar			
DZA	Algeria	Ain Djasse	WRI10237	520	35.8665	6.0262	Gas	Oil						SociÃ¢tÃ© Arab Unio	http://ww/KTH	1069670		
DZA	Algeria	Ain Sekho	WKS00685	20	34.532	0.804	Solar							Wiki-Solar	https://w/Wiki-Solar			
DZA	Algeria	Ain el Ibel	WKS00685	20	34.346	3.164	Solar							Wiki-Solar	https://w/Wiki-Solar			
DZA	Algeria	Ain el Ibel	WKS00734	53	34.342	3.169	Solar							Wiki-Solar	https://w/Wiki-Solar			
DZA	Algeria	Ain el Mel	WKS00685	20	34.861	4.204	Solar							Wiki-Solar	https://w/Wiki-Solar			
DZA	Algeria	Algerie Su	WKS00685	43.5	27.908	-0.317	Solar							Wiki-Solar	https://w/Wiki-Solar			
DZA	Algeria	Annaba	WRI10237	71	36.8924	7.7634	Gas							SociÃ¢tÃ© Arab Unio	http://ww/GEODB	1029479		
DZA	Algeria	Aoulef	WKS00685	5	26.9989	1.3351	Solar							Wiki-Solar	https://w/Wiki-Solar			
DZA	Algeria	Arbaa	WRI10237	560	36.5988	3.1375	Gas	Oil						SociÃ¢tÃ© Arab Unio	http://ww/GEODB	1069669		

# Data before cleaning

## Data after cleaning



# Data Cleaning & Transformation

Country	capacity_megawatts	latitude	longitude	primary_fuel
China	22500	30.8235	111.0032	Hydro
China	13050	28.2606	103.6484	Hydro
China	12600	28.2600	103.6500	Hydro
Russia	8865	61.2794	73.4889	Gas
Venezuela	8851	7.7659	-62.9982	Hydro
Brazil	8535	-3.8322	-49.6522	Hydro
Japan	8212	37.4259	138.5941	Nuclear
Brazil	7000	-25.4269	-54.5931	Hydro
Paraguay	7000	-25.4081	-54.5889	Hydro
China	7000	44.6885	89.1138	Coal
United States of America	6809	47.9575	-118.9773	Hydro
Saudi Arabia	6794	20.6300	39.5550	Oil
China	6720	40.1947	111.3589	Coal
China	6448	28.6437	104.3930	Hydro
China	6300	25.0277	107.0431	Hydro
Russia	6000	55.9367	92.2956	Hydro
Ukraine	6000	47.5119	34.5863	Nuclear
China	6000	40.6876	95.7329	Wind
South Korea	5900	35.4105	126.4175	Nuclear
South Korea	5900	37.0931	129.3830	Nuclear
China	5850	22.6409	100.4287	Hydro
Kuwait	5805	28.7072	48.3742	Gas
Russia	5690	55.9162	37.6879	Gas
Canada	5616	53.7818	-77.5305	Hydro
Taiwan	5500	24.2131	120.4850	Coal
Poland	5472	51.2679	19.3265	Coal
France	5460	51.0141	2.1332	Nuclear
Canada	5428	53.5294	-63.9651	Hydro
Kuwait	5366.5	29.5670	48.1710	Gas
Indonesia	5355	-7.7184	113.5827	Coal
France	5320	49.8582	0.6354	Nuclear
China	5240	31.3536	121.6003	Coal
France	5200	49.4160	6.2169	Nuclear
South Korea	5080	37.2369	126.4361	Coal
China	5060	29.9433	121.8131	Coal
Japan	5040	35.3421	139.8319	Gas
China	5000	30.6283	121.1436	Coal
China	5000	21.8664	112.9278	Coal

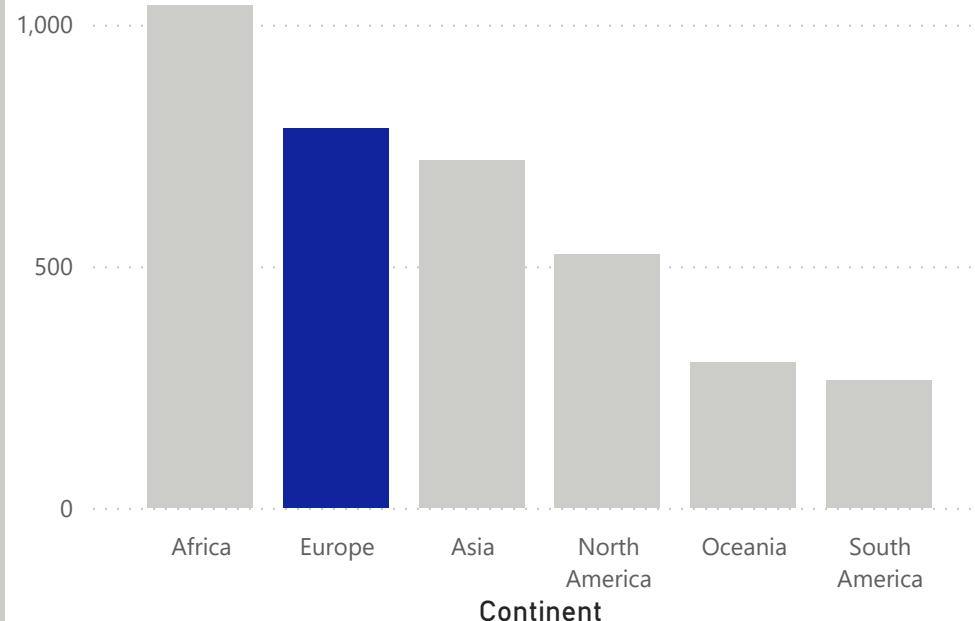
Country	Year	% Renewable energy consumption
Democratic Republic of Congo	2001	98.34%
Democratic Republic of Congo	2002	98.27%
Democratic Republic of Congo	2003	97.97%
Democratic Republic of Congo	2000	97.94%
Democratic Republic of Congo	2004	97.88%
Democratic Republic of Congo	2005	97.42%
Democratic Republic of Congo	2006	97.33%
Democratic Republic of Congo	2007	97.17%
Democratic Republic of Congo	2016	97.03%
Democratic Republic of Congo	2009	97.02%
Democratic Republic of Congo	2008	96.97%
Democratic Republic of Congo	2010	96.81%
Democratic Republic of Congo	2017	96.70%
Democratic Republic of Congo	2018	96.38%
Democratic Republic of Congo	2019	96.24%
Democratic Republic of Congo	2011	96.21%
Burundi	2004	96.04%
Burundi	2005	96.01%
Democratic Republic of Congo	2015	95.82%
Burundi	2003	95.76%
Ethiopia	2000	95.55%
Democratic Republic of Congo	2012	95.47%
Uganda	2002	95.35%
Burundi	2006	95.31%
Burundi	2007	95.29%
Uganda	2003	95.28%
Uganda	2001	95.22%
Burundi	2009	95.18%
Burundi	2008	95.15%
Central African Republic	2013	95.08%
Somalia	2019	95.03%
Uganda	2004	95.02%
Uganda	2000	95.01%
Somalia	2018	94.93%
Somalia	2017	94.90%
Burundi	2001	94.84%
Central African Republic	2014	94.82%
Somalia	2016	94.78%

# Data after cleaning



# Data Analysis

Data Distribution: Renewable energy consumption by Continent



Data Distribution: Count of powerplants by Continent

